# *WHY SOME FIELDS MIGHT BE RECTANGULAR: AN EXPLORATION OF AGRICULTURAL LANDSCAPES BETWEEN PRE-CAPITALIST AND CAPITALIST MODES OF PRODUCTION*

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**Abstract**

This article is a preliminary investigation of possible spatial form which starts by rejecting the idea that spatial theory can be built from assumptions of isomorphism. It examines spatial form in high potential ridge valley areas which are densely populated, and identifies the transition in land configuration for pre-capitalist to capitalist modes of production. In building the argument simple geometric patterns that differentiate from the model are postulated. The basic drivers of the differing spatial systems are essentially the superstructural legal conditions which are postulated as a moving from communal, customary law to individual statutory property rights.

**Keywords:** Pre-capitalist, capitalist, customary law, statutory property rights, spatial systems

**Por qué Algunos Campos Pueden ser Rectangulares: Una Exploración de Paisajes Agrícolas entre Modos de Producción Capitalistas y Pre-Capitalistas**

**Resumen**

Este artículo es una investigación preliminar de posible forma espacial que comienza por rechazar la idea de que la teoría espacial puede ser construida desde suposiciones de isomorfismo. Aquí se analiza la forma espacial de valles de montaña con alto potencial y densamente poblados, y se identifica la transición en la configuración de la tierra de modos de producción pre-capitalistas a capitalistas. Para ello se proponen patrones geométricos simples que se diferencian del modelo. Las diferencias más básicas en los sistemas espaciales son esencialmente las condiciones legales superestructurales, que sufrieron un movimiento desde

los derechos consuetudinarios comunales hacia los derechos estatutarios de propiedad individual.

**Palabras clave:** Pre-capitalista, capitalista, ley consuetudinaria, derechos estatutarios de propiedad, sistemas espaciales.

**Introduction**

This paper outlines a theoretical model for the spatial analysis of agricultural systems under pre capitalist and capitalist modes of production in areas of high ecological value. The title is deliberately non-deterministic as is the starting of the analysis. The starting point of the analysis is a rejection of the assumptions of isomorphism that lay behind the classic spatial theories of von Thunen, Losch and Chrystaller. As economic geographers, we have frequently wondered aghast at why colleagues would wish to abandon the existence of nature in all its variations to build theories of the economy under capitalism but, in one sense we are unsurprised since the very drive to accumulation is a drive for mass uniformity which includes a uniformity of nature. Our starting point, using the Kikuyu landscape, is to abandon spatialities of isomorphism and to try and theorize the landscape that we see before us.

**The African Landscape**

The impression that the Kikuyu landscape makes upon the traveler or scientist is very favorable. After the aridity of the plains, the sight of the flowing ridges and valleys, sporting their green finery, is very moving. What is equally striking is the orderliness of the field system. Their orderliness was emphasized by the land reorganization but it was also inherent in the traditional pattern of tenure:

> "Each landowner was given access to a road and to water whenever possible and the new holdings tend to run in long narrow strips from the ridge tops to the valley bottom. This ensures that whenever possible each landowner gets a share in the ridge top land, the valley side land and the valley bottom land, as was the custom in the past. " (Taylor, 1969, 475)

In the traditional Kikuyu society, the Mbari or the elementary family held tracts of land, was how Kikuyu country was divided. Any married man had rights to the plots of Mbari and further control over residential, arable and grazing rights. The plots were transferable if the transaction did not involve the permanent alienation of that land; if permanent alienation was involved then the head of the family would have to obtain the consent of Muramati, the administrator of traditional holdings, a practice which reveals the residuary rights of the kinship group (Lambert, 1956). With ownership of the land went responsibility and trusteeship, particularly towards the communal rights exercised in water supplies, paths, market sites and grazing. The social structure was reflected in the system of land tenure wherein the family identified with a particular piece of land; the male descendants, particularly the eldest son, had perpetual rights through time. Women had no rights to transactions in land, and access was based on ties of friendship and affinity; land was, therefore, a medium through which social ties were expressed. Taylor summarizes this situation admirably when he realized the implication of two apparently antagonistic principles constantly in operation – community kinship and the individual rights; it was the genius of the native (sic) system that it preserved a stable equilibrium between the two (Taylor, 1969).

Several authors have agreed that there has been an agricultural revolution as a result of the consolidation and redistribution of land in Kikuyu country, but few have realized its limitations. Taylor (1969) stresses that there was not enough land to go around in the original redistribution of land so that it is not surprising that there are apparent shortages. Even if the land frontier were constantly open, it is doubtful if they could absorb the population surplus of this area.

**Developing the Argument**

Kikuyu land divisions have frequently been described as linear. The same term has been applied to agricultural conditions in Thailand, Borneo and Canada. The Kikuyu situation is, however, more interesting in that topographically it is the limiting case. It has already

been indicated that the area supports a system of rectilinear slopes and that the soil catena varies down the slopes according to slope steepness with the steepest slopes having the poorest soils. Roads run along the tops of the slopes and the rivers obviously along the valley bottoms (a similar road network is observable in the Medieval United Kingdom landscape where roads ran the ridge tops to avoid fording rivers). Theoretically, therefore, one can consider the surface as topologically flat, constrained on either side by two parallel barriers, the river and the road (Figure 1).

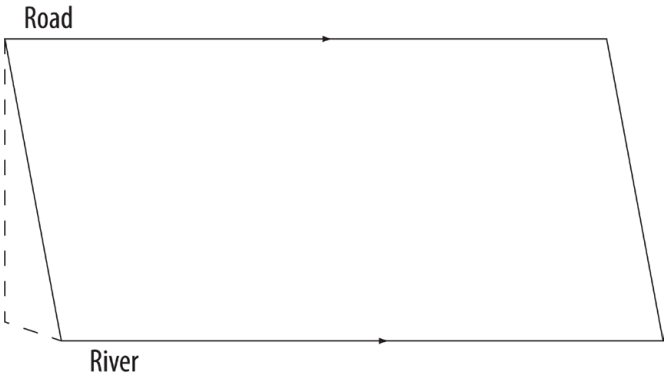


**Figure 1**

The perfect land division is rectangular because of the Euclidean principle that the shortest distance between two straight lines is the perpendicular. The most efficient geometric configuration for 'N' farmers is that of linear land use (Figure 2).

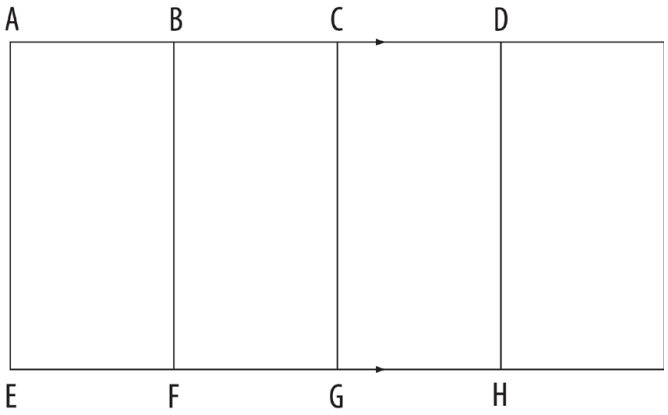


**Figure 2**

Figure 3 examines this situation in more detail where non-perpendicular divisions are introduced. For the rectangle ABEF to be equal in area to the trapezium AXEY then XY must pass through the central point of BF which is called Z. Triangle ZXB and Triangle FZY are similar and, therefore, XB equals FY.

Thus,

$$AX + EY = AB + EF$$

However, $XY > BF$

It is concluded that to gain the greatest equal area for 'N' farmers on a given surface then the division of the land must be rectangular.

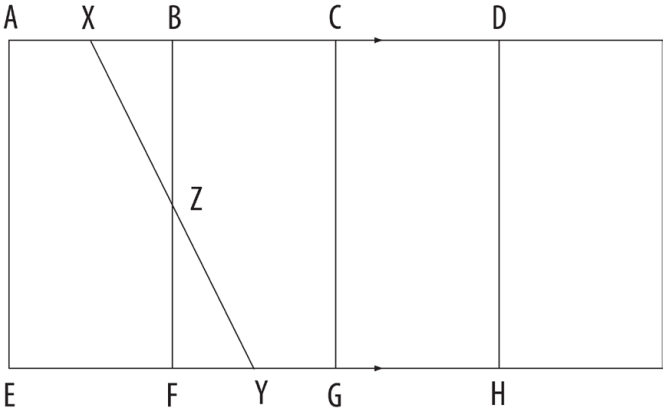


**Figure 3**

We have already noted significant ecological variation between the upper, middle and lower slopes where the lowest are the most productive and the upper the least. Under colonial attempts at land reform, the Swynnerton Plan recognized the inherent physiographic difference when it suggested that a minimum standard layout should be adopted on all farms. The farmer was advised to grow food crops on the slopes of less than 20 degrees, cash crops on slopes between 20 and 35 degrees and trees and permanent grass on slopes greater than 35 degrees (quoted in Taylor, 1969, 477). In fact, peasant farmers most intensively developed the valley bottoms where there was little slope and soil accumulation rather than erosion; it is the only site in Kikuyu land where sugar cane can be grown, from which the local beer is produced, the crop of social reproduction. It can be argued that all farmers are competing for the land on the valley bottom and then whatever is available (Figure 4). In fact the Swynnerton Plan precisely proposed such a solution but applied individual rights and statutory

land tenure to implement this scheme of equal access to upper, middle and lower slope land.

| | | | |
|---|---|---|---|
| U | U | U | U |
| M | M | M | M |
| L | L | L | L |

**Figure 4**

The problem with individual statutory tenure, rather than communal ownership under customary law, is that land itself becomes alienable with richer farmers, or absentee landlords, accumulating valley bottom land and the poorer peasantry being forced up the hill where, in order to get sufficient land for food production, they frequently have to cut down forest areas or uproot grazing areas with consequent problems of soil erosion. In short with capital accumulation we would expect to see land variation and attendant environmental problems.

It is possible to formulate simple scales by which this variation can be measured. The first spatial variation is indicated by Figure 5 where none of the divisions is rectangular. From Figure 2 the ratios AB:EF, BC:FG and CD:GH will always be 1 as the fields are rectangular. In Figure 5 the ratio AB:GH will be greater than 1 because of more hill-top land. The ratio BC:HI will be less than 1 because of more valley-bottom land. A ratio between hill-top land and valley-bottom land of 1 reflects the ideal division of land types as shown in Figure 2. By averaging the ratios of plots it can be argued that this is a measure of the efficiency of land division, with 0 being the worst case and 1 being the optimum. An examination of the 1963 land tenure maps indicated that the land divisions of Gakarara calibrated at 0.83, indicating a high degree of efficient land division (O'Keefe, 1974).

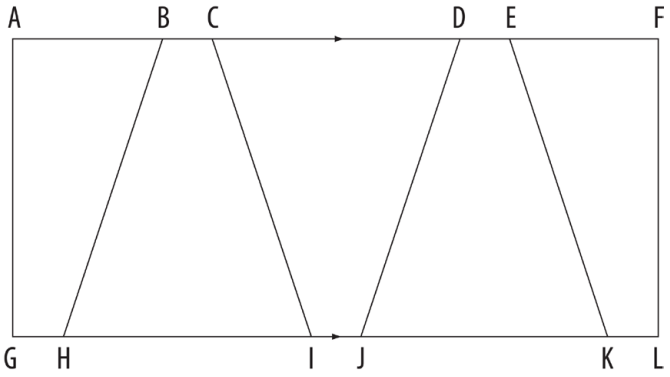


**Figure 5**

Another interesting variation is that illustrated in Figure 6, where the land division is an enclave. Here a similar scale solution can be found if one sums the number of lines that cut the parallel constraints.

Let,

N1 be the number of lines that cut one parallel line,

N2 be the number of lines that cut the other parallel constraint,

N be the total number of divisions,

Thus,

$$N1 + N2 = 2N \text{ is a perfect situation}$$

Therefore,

$$N1, N2 = 2N$$

$$N1 > N \text{ is imperfect}$$

$$N2 < N \text{ is imperfect}$$

$$N1 + N2 \neq 2N \text{ is imperfect}$$

Thus,

$$\text{If } N1 + N2 < 2N,$$

Then,

$$\frac{N1 + N2}{2N} < 1$$

The index, therefore, is

$$\frac{N1 + N2}{2N}$$

Which runs from 0 - 1

For each parallel the equation reads,

$$\text{Index} = N1/N$$

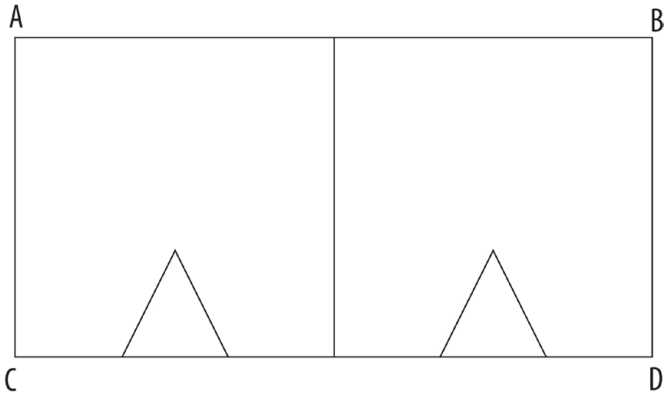


**Figure 6**

We would logically expect the rectangular fields that come down the hillsides to change from a vertical land distribution to a horizontal one where the rich held the valley bottom, middle income farmers held the middle slopes and the poor, if allowed access, would own the hilltops. We would expect the dominant road system to be transferred to the river valley i.e. the richer production area, and would expect to see increasing control by the state of the ridge tops to retard deforestation and the destruction of grazing land (see Figure 7). In short our horizontal fields would reflect a movement to the capitalization of agriculture away from the vertical land distribution of pre capitalist modes of production. Landscape ultimately reflects relative power relationships where wealth is concentrated in valley bottom opportunity.

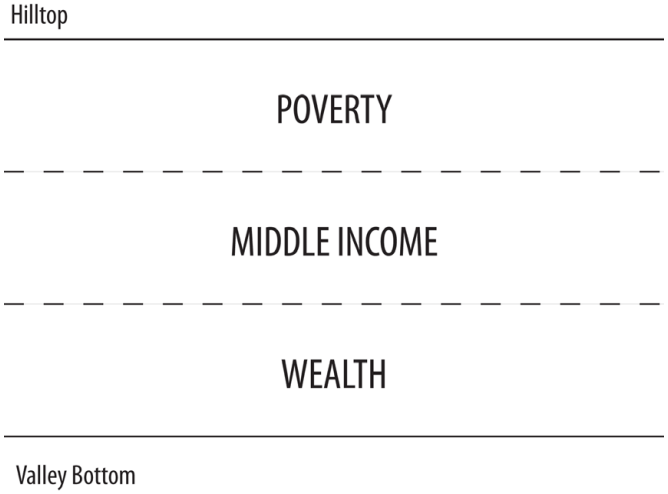


**Figure** 7

**Concluding Thoughts**

There is a link between simple land-use modeling to broader human environment relations. In our work on disasters over the last fifty year we have particularly noticed the increased severity of tropical storms on landscapes where traditional practices have effectively been cancelled. In particular we think of the landscapes of Central America where hurricane Fifi (1974) and hurricane Mitch (1998) effectively 'selected the poor' because they were marginalized people on marginalized land. Beware the shift from the vertical to horizontal[1].

These models of land use emerge from an assumption that nature is not universalized as frequently assumed by isomorphic models. On the contrary modeling real land values shows how pre capitalist communitarian traditions are overrun by private accumulation, including the accumulation of land, to the wealthy in river valleys. The assumptions behind these arguments are essentially that this is high potential river valley country which is demographically fully occupied. Other model would exist for different ecologies and different demographic conditions.

**Acknowledgement**

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1 There are no extra marks for trying to create a GIS exercise out of the model.